Male connector located by spring ring in circumferential groove.

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Abstract

A male splined drive 13 has a groove 14 in which is captured a spring ring 15. As the drive wheel 20 slides over the male splined drive 13, it compresses the spring ring 15 into the groove 14. When the pulley wheel 20 is fully on the male splined drive 13, the spring ring 15 expands into the recess 26 and retains the drive wheel 20 on the shaft 10.

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(54) Abstract Title
Male connector located by spring ring in circumferential groove.

(57) A male splined drive 13 has a groove 14 in which is captured a spring ring 15. As the drive wheel 20 slides over the male splined drive 13, it compresses the spring ring 15 into the groove 14. When the pulley wheel 20 is fully on the male splined drive 13, the spring ring 15 expands into the recess 26 and retains the drive wheel 20 on the shaft 10.

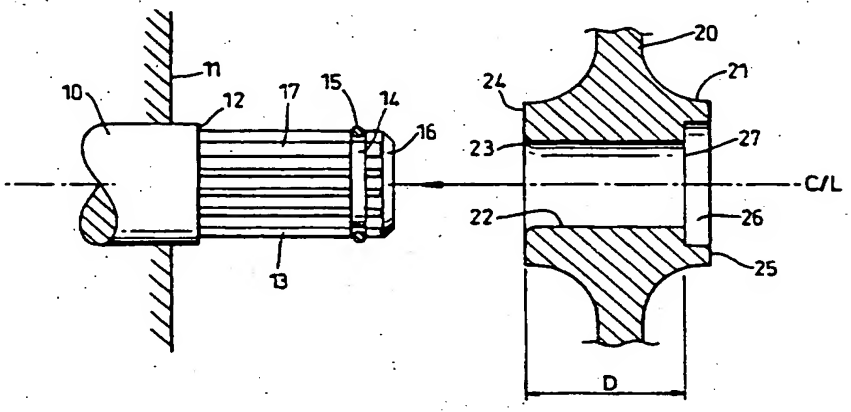

Fig. 1

GB 2 321 945 A

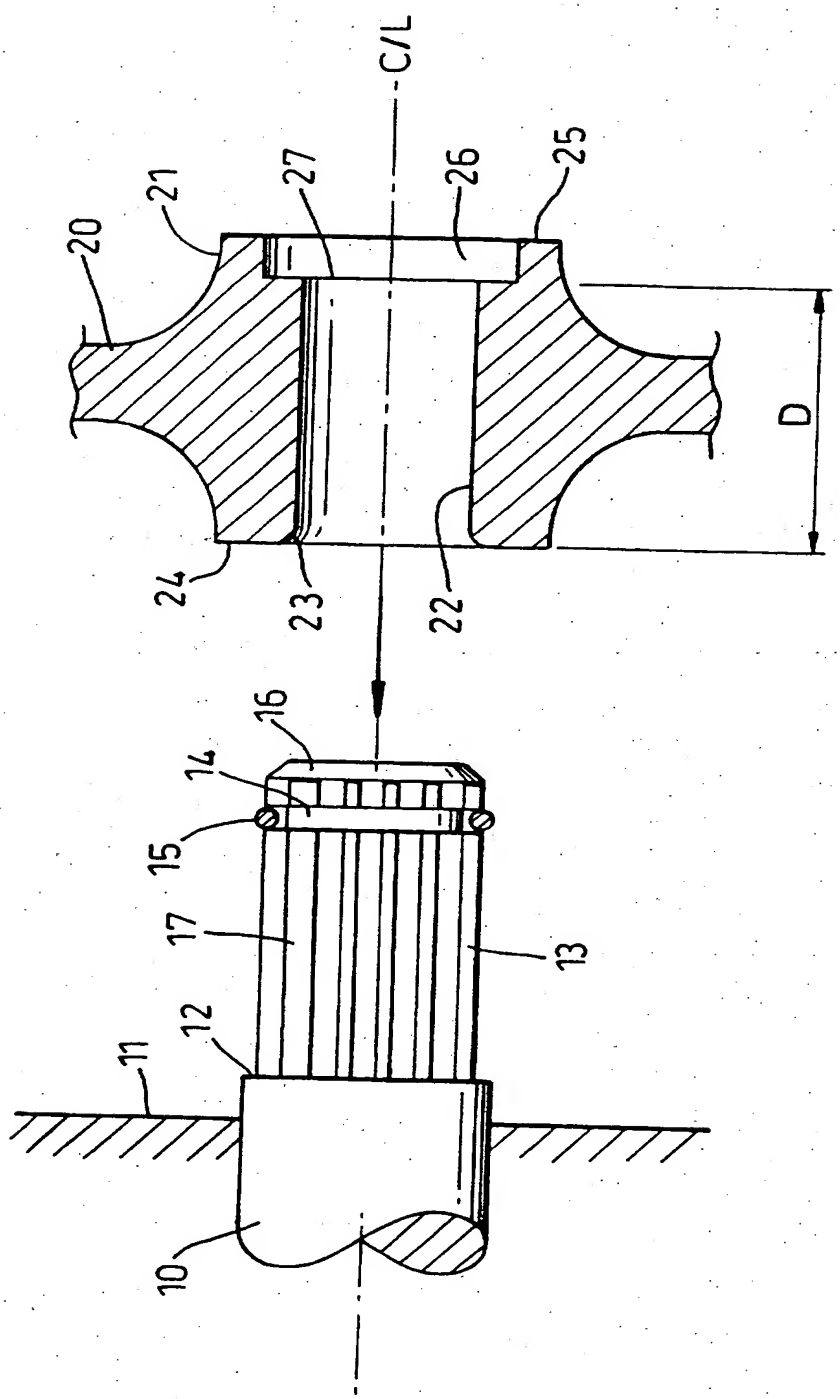

Fig. 1

An Internal Combustion Engine And A Method Of Assembling A Drive Wheel To A Shaft Thereof.

This invention relates to internal combustion engines and in particular to a method of fixing a wheel to a shaft of an internal combustion engine.

It is known to provide drive to or from a shaft of an internal combustion engine by fixing a drive wheel to it. Conventionally the drive wheel is engaged with a spigot formed on the shaft and is retained in place by a bolt screwed axially into the end of the spigot. Rotational movement is translated between the shaft and the wheel by a keyed driving member, often of the type known as a "woodruff key," which is engaged with both the spigot and the drive wheel. Such a method of attachment can be used to drivingly connect drive wheels of the geared, pulley or chain-wheel type that require to be rotated or from which drive is obtained.

It is an object of this invention to provide an improved shaft and drive wheel assembly and an improved method of assembling and retaining a drive wheel onto a shaft.

According to the invention there is provided an internal combustion engine having a shaft and a drive wheel drivingly retained thereon, the shaft having an end portion formed into a male driving means, a circumferential groove formed in the male driving means in which a spring

ring is held captive, the spring ring having a maximum diameter which is greater than the minimum diameter of the male driving means, the drive wheel having a female driving means formed therein having a minimum diameter which is less than the maximum diameter of the spring ring such that upon full engagement of the drive wheel with the male driving means, the spring ring engages with the drive wheel, thereby to retain the drive wheel on the shaft.

The spring ring may be compressed into the groove during engagement of the drive wheel with the shaft.

The female driving means may have a tapered end portion to assist with the axial alignment of the drive wheel with the shaft and preferably the tapered end portion may be a chamfer formed in the drive wheel.

The engine may further comprise a shoulder on the shaft extending radially from the male driving means and preferably the drive wheel may be trapped against the shoulder by the spring ring to control the end float of the drive wheel on the shaft.

The male driving means may be a male splined drive and the female driving means may be a female splined drive.

The shaft may be a camshaft of the engine and the drive wheel may be a camshaft drive wheel of the engine.

The invention also provides a method of fixing a drive wheel to a shaft of an internal combustion engine, the shaft having an end portion formed into a male driving means, a circumferential groove formed in the male driving means and a spring ring captured in the groove, the spring ring having a maximum diameter which is greater than the minimum diameter of the male driving means, the drive wheel having a female driving means for engagement with the male driving means, the female driving means having a minimum diameter which is smaller than the maximum diameter of the spring ring, the method comprising the steps of:

a/ axially aligning the female driving means with the end portion of the shaft;

b/ sliding the female driving means into engagement with the male driving means until the female driving means contacts the spring ring;

c/ forcing the female driving means over the spring ring thereby compressing the spring ring into the groove such that the outer diameter of the spring ring does not extend beyond the minimum diameter of the female driving means; and

d/ sliding the female driving means into further engagement with the male driving means such that the spring ring engages with a radially extending surface of the drive wheel, thereby retaining the drive wheel on the shaft.

The invention will now be described by way of example with reference to the accompanying drawing in which:

Figure 1 shows a shaft and a drive wheel prior to assembly of the drive wheel onto the shaft.

With reference to Figure 1, a shaft in the form of a camshaft 10 for an internal combustion engine is rotatable about a fixed axis C/L and is supported on that axis C/L by bearings 11 (only one of which is shown). The end portion of the camshaft 10 has a shoulder 12 from which protrudes a male driving means in the form of a spigot at a reduced diameter formed into a male splined drive 13. The male splined drive 13 has a groove 14 formed in it and a spring ring 15 is captured in the groove 14.

The spring ring 15 is biased outwardly from the groove 14 and in its uncompressed state its outer diameter extends beyond the maximum outer diameter of the male splined drive 13. The groove 14 is sufficiently deep for the spring ring 15 to be compressed into it such that the maximum diameter

of the spring ring 15 does not protrude above the minimum diameter of the male splined drive 13 and the groove 14 is substantially the same width as the spring ring 15.

The end of the male splined drive 13 tapers down to form an axial alignment means in the form of a locating chamfer 16. The male splined drive 13 further comprises an angular alignment means in the form of a double width male spline 17.

A drive wheel 20 is shown sectioned through its driving hub 21 and axially aligned with the camshaft 10 along the axis C/L. The hub 21 has a central bore in which is formed a female splined drive 22. A chamfer 23 is formed at one end of the female splined drive 22, which is arranged to co-operate with the locating chamfer 16 of the male splined drive 13. The female splined drive 22 has a double width spline groove (not shown) which is arranged to engage with the double male spline 17 when angularly aligned along the axis C/L upon assembly of the drive wheel 20 and camshaft 10.

The hub 21 has a front face 24 which is machined for abutment with the shoulder 12 and a rear face 25 out of which is machined an annular recess 26 for co-operation with the spring ring 15. The axial distance D between a bottom face 27 of the recess 26 and the front face 24 is

substantially equal to the axial distance between the rear edge of the groove 14 and the shoulder 12.

To assemble the drive wheel 20 onto the camshaft 10, the female splined drive 22 is offered up to the male splined drive 13 along the shaft axis C/L. The chamfer 23 leads the locating chamfer 16 into the female splined drive 22.

The drive wheel 20 is pushed towards the camshaft 10 and is rotated about the axis C/L until the portion of the double width male spline 17 formed in front of the spring ring 15 is aligned with the double width spline groove.

The drive wheel 20 is pushed towards the camshaft 10 until the chamfer 23 comes up against the spring ring 15. The spring ring 15, in its uncompressed state, provides resistance to the further sliding of the female splined drive 22 along the male splined drive 13.

The resistance is overcome by forcing the female splined drive 22 over the spring ring 15 by, for example, a sharp blow to the rear face 25 with a nylon mallet. The female chamfer 23 then rides over the spring ring 15 thereby compressing it into the groove 14 below the minimum diameter of the female splined drive 22 allowing the female splined drive 22 to continue

to slide along the male splined drive 13 until the front face 24 abuts the shoulder 12.

Just prior to abutment, the groove 14 and the recess 26 come into alignment thereby allowing the spring ring 15 to be released from its compressed state in the groove 14. The spring ring 15 then expands into the recess 26 and assumes its uncompressed state and acts against the bottom face 27 to retain the drive wheel 20 on the camshaft 10 and also acts to control the end float of the drive wheel 20 on the camshaft 10 by trapping the drive wheel 20 between the spring ring 15 and the shoulder 12.

To remove the pulley wheel 20 the spring ring 15 is accessed and compressed through the open side of the recess 26 on the level of the rear face 25 of the drive wheel 20.

CLAIMS

1. An internal combustion engine having a shaft and a drive wheel drivingly retained thereon, the shaft having an end portion formed into a male driving means, a circumferential groove formed in the male driving means in which a spring ring is held captive, the spring ring having a maximum diameter which is greater than the minimum diameter of the male driving means, the drive wheel having a female driving means formed therein having a minimum diameter which is less than the maximum diameter of the spring ring such that upon full engagement of the drive wheel with the male driving means, the spring ring engages with the drive wheel, thereby to retain the drive wheel on the shaft.

2. An engine according to Claim 1 wherein the spring ring is compressed into the groove during engagement of the drive wheel with the shaft.

3. An engine according to Claim 1 or Claim 2 wherein the female driving means has a tapered end portion to assist with the axial alignment of the drive wheel with the shaft.

4. An engine according to Claim 3 wherein the tapered end portion is a chamfer formed in the drive wheel.

5. An engine according to any preceding Claim further comprising a shoulder on the shaft extending radially from the male driving means.

6. An engine according to Claim 5 wherein the drive wheel is trapped against the shoulder by the spring ring to control the end float of the drive wheel on the shaft.

7. An engine according to any preceding Claim wherein the male driving means is a male splined drive.

8. An engine according to any preceding Claim wherein the female driving means is a female splined drive.

9. An engine according to any preceding Claim wherein the shaft is a camshaft of the engine.

10. An engine according to Claim 9 wherein the drive wheel is a camshaft drive wheel of the engine.

11. A method of fixing a drive wheel to a shaft of an internal combustion engine, the shaft having an end portion formed into a male driving means, a circumferential groove formed in the male driving means and a spring ring captured in the groove, the spring ring having a maximum diameter which is greater than the minimum diameter of the male

driving means, the drive wheel having a female driving means for engagement with the male driving means, the female driving means having a minimum diameter which is smaller than the maximum diameter of the spring ring, the method comprising the steps of:

a/ axially aligning the female driving means with the end portion of the shaft;

b/ sliding the female driving means into engagement with the male driving means until the female driving means contacts the spring ring;

c/ forcing the female driving means over the spring ring thereby compressing the spring ring into the groove such that the outer diameter of the spring ring does not extend beyond the minimum diameter of the female driving means; and

d/ sliding the female driving means into further engagement with the male driving means such that the spring ring engages with a radially extending surface of the drive wheel, thereby retaining the drive wheel on the shaft.

12. The method of Claim 11 wherein the drive wheel has a chamfer formed therein to assist with engagement of the drive wheel with the shaft.

13. The method of Claim 11 or Claim 12 wherein the male driving means comprises a male splined drive.

14. The method of any one of Claims 11 to 13 wherein the female driving means comprises a female splined drive.

15. The method of any one of Claims 11 to 14 wherein the shaft comprises a camshaft of the internal combustion engine.

16. The method of Claim 15 wherein the drive wheel comprises a camshaft drive wheel of the internal combustion engine.

17. A method substantially as described in Claims 11 to 16 with reference to the accompanying drawing.

18. An internal combustion engine having a shaft and wheel substantially as described herein with reference to the accompanying drawing.

The Patent Office

19

Application No: GB 9702755.1
Claims searched: 1-18

Examiner: J. C. Barnes-Paddock
Date of search: 15 April 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F2U U374

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Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2,270,054 A	(GENERAL MOTORS) See Fig. 1 and page 7, ll 10-17 and the para bridging pages 7 and 8.	1-5,7,8, 11-14
X	GB 2,199,114 A	(HARDY SPICER) Fig. 4 and page 10, ll 15-18.	1,2,7,8, 11, 13, 14
X	GB 2,142,294 A	(UNI-CARDAN) See Figure and page 1, lines 111-117	1,5,7,8
X	GB 1,431,664	(CATERPILLAR) Figs. 1,4 and see page 2, ll 10-53 72-92.	1-8, 12-14
X	US 4,781,487	(SCIENTIFIC INDUSTRIES) See Figs and col 4, ll 5-20	1-6,11,12

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.